OBSERVATIONS ON THE INTRAVENOUS USE OF STROPHANTHIN WITH REGULAR AND IRREGULAR PULSE RHYTHMS.

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Since Fraenkel,[1] in 1906, reported the value of intravenous injections of strophanthin in heart failure—noting increased amplitude and slowing of the pulse, together with diuresis—observations on the intravenous use of this drug with favorable results have followed in considerable numbers from other writers. However, these observations have not been explicit as to the type of cases in which strophanthin was employed, and until the more recent reports of Agassiz[2] and Linnell,[3] have produced the impression that it yielded beneficial results in all cases of heart failure, regardless of the pulse rhythms. This is clearly not so, and the type of cases in which good results are obtained is so sharply defined that it would seem to deserve more emphasis than it has generally received.

The present report is made with the object of studying further the nature and duration of the actions of strophanthin in cardiac lesions, with particular reference to the pulse rhythm present, since this feature decides how effectual the injections will prove. The work of Mackenzie[4] has made clear that digitalis and its allies produce their striking results in a clearly marked group of clinical cases. Definite slowing of the pulse under digitalis occurs in the presence of the pulsus irregularis perpetuus and the ventricular form of venous pulse, the complex familiar as auricular fibrillation. In conditions other than auricular fibrillation it produces also at times a slowing of the pulse that is more apparent than real and occasionally to the disadvantage of the patient. It is a matter of record that digitalis administration in the presence of a normal regular pulse rhythm may produce for the time being, and sometimes permanently, any of the commoner irregularities of the heart, such as premature contractions, phasic variations, heart-block, pulsus alternans, and auricular fibrillations (Fig. 1). Frequently, too, the finger is taken as a guide to the slowing of the pulse in these instances, and may readily lead to erroneous conclusions, since an apparently long interval between pulse waves may be due to a weak contraction perceptible at the

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[1] Fraenkel, Verhand. d. Kongress f. innere Medizin, 1906, xxiii, 257.

[2] Agassiz, C. D. S., Observations on the Effect of Strophanthin in Cases of Auricular Fibrillation, Heart, vol. iii, No. 4, p. 353.

[3] Linnell, J. W., The Use of Strophanthin Administered Intravenously in Cases of Heart Disease. Publication printed for private circulation, London, 1913.

[4] Mackenzie, James, Digitalis, Heart, vol. ii, No. 4.

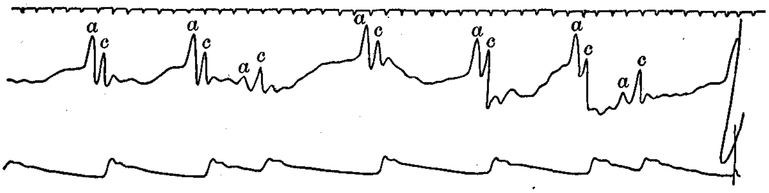

FIG. 1 (*a*).—Marked sinus arrhythmia induced by digitalis in a previously regular pulse.

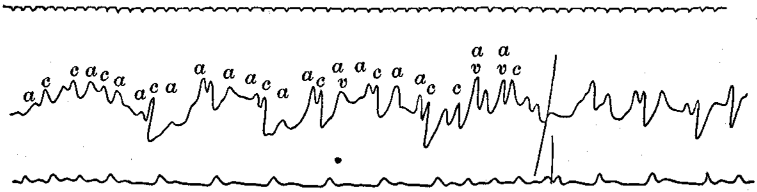

FIG. 1 (*b*).—Heart block occasioned in a previously regular pulse by digitalis (septic endocarditis).

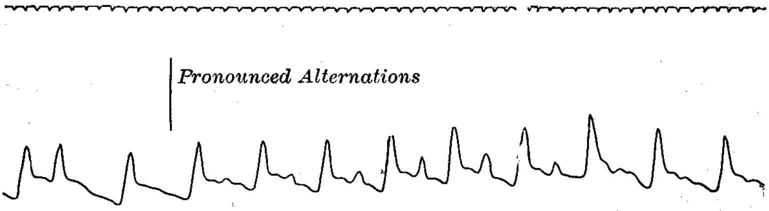

FIG. 1 (*c*).—Pulsus alternans.

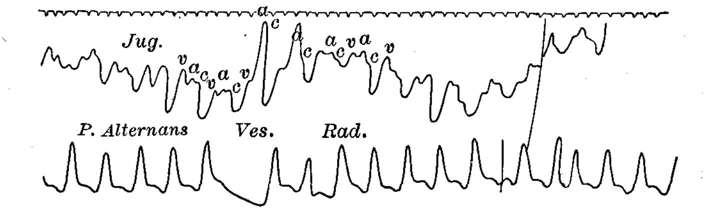

FIG. 1 (*d*).—Ventricular extrasystole induced in a previously regular pulse after a total administration of f℥iij tinct. strophanthus.

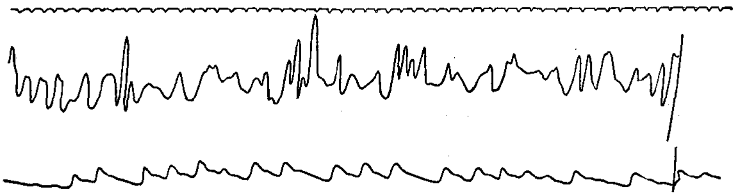

FIG. 1 (*e*).—Auricular fibrillation (permanent) induced after ♏xxx tinct. digitalis. Case of Dr. J. D. Heard.

FIG. 1.—Illustrating irregularities brought on in previously regular pulse rhythms by the administration of digitalis and strophanthus. Time marked in all cases in one-fifth second.

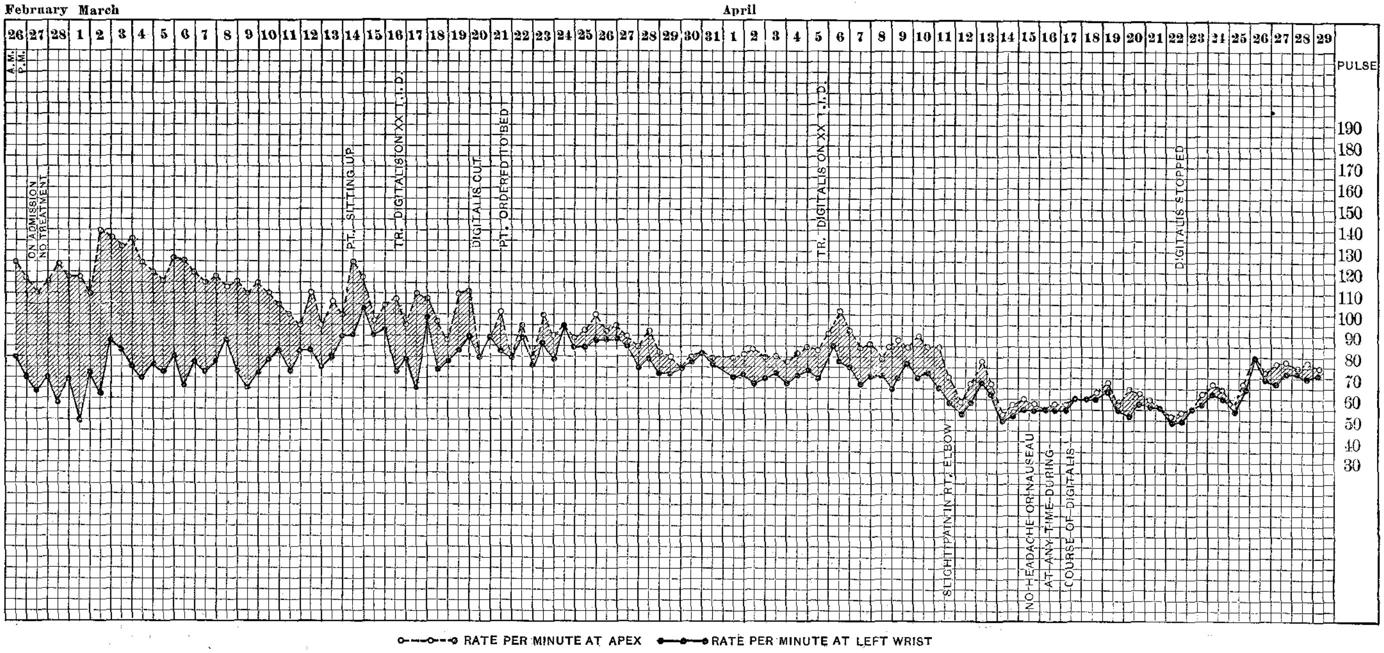

FIG. 2.—Showing diminution of pulse deficit after digitalis administration in auricular fibrillation. Upper level, apex rate. Lower level, pulse at wrist.

apex but too feeble to reach the wrist. The same holds true to even a greater degree in auricular fibrillation, as is commonly attested by most clinical charts, the pulse rate as recorded by the nurse being many counts below the actual heart beat. This difference in rate between apex and radial pulse—the pulse deficit—may, as pointed out by James and Hart,[5] be made a guide to the patient's improvement, since it progressively grows less or even disappears under treatment (Fig. 2).

In the present observations the pulse has been termed irregular in the presence of a disorderly rhythm with no two beats alike in length or amplitude, and a positive venous pulse, and regular if there is evidence of an underlying, orderly arrangement of contractions, even though these be interrupted by contractions of atypical origin. In all, twenty cases with regular and irregular pulse rhythms were studied. Those having regular rhythms were all clearly definied, and showed no intercurrent irregularities.

Preparations Used and Dosage. Two forms of strophanthin were used, and, so far as could be judged, showed no difference in efficiency—the ampoules of Boehringer containing 1 mg. each, or $\frac{1}{60}$ gr., and the tablets of Burroughs, Wellcome & Co., of $\frac{1}{500}$ gr. each, dissolved in sterile water. As a rule $\frac{1}{60}$ gr. was employed. A dose of less than $\frac{1}{120}$ gr. did not prove practicable, and, except in one instance that will be mentioned, we saw no ill effects from $\frac{1}{60}$ gr. The smaller the dose the more frequently it may be employed, but since the procedure is not a painless one, it seemed always desirable to give at one time the largest dose within the limits of safety. A dose of $\frac{1}{60}$ gr. should, and need, scarcely be repeated in less than forty-eight hours.

The injection was made with a hypodermic syringe into a vein at the bend of the elbow, the arm having been surgically cleansed and a tourniquet applied. It is important after introducing the needle, and before pressing the plunger, to see that blood is flowing into the syringe so as to make sure that none of the injection enters the subcutaneous tissues and causes a cellulitis. In two cases a red, swollen, tender arm resulted from some of the strophanthin escaping into the subcutaneous tissues, the symptoms subsiding after three or four days. One case, already *in extremis*, had her death hastened by what must have been too great a dose for her body weight. Otherwise, no ill effects were noted, such as rigors, headaches, and rises of temperature, which some observers have reported.

Effect on the Heart Rate and its Duration. In those cases which reacted, slowing of the pulse rate occurred within twenty minutes, though in some instances a maximal effect was not obtained for six to eight hours. Where a sufficient dose was injected to obtain a maximal slowing, the pulse did not begin to accelerate again for three to ten days. The duration of the effect seemed to be proportionate to the extent of slowing rather than to the dosage employed, as already noted by Agassiz.[6]

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[5] James and Hart, Auricular Fibrillation, Clinical Observations on Pulse Deficit, Digitalis, and Blood-pressure, Amer. Jour. Med. Sci., January, 1914, p. 63.

OTHER EFFECTS. Where the subjective symptoms are urgent, the effect of strophanthin in suitable cases is most striking. Coughing and dyspnea cease within a few minutes, and the patient experiences a relief comparable in its rapidity only to that obtained from morphine, while the heart rate is sufficiently lowered to tide him over until digitalis, administered orally, can produce its effects.

On the other hand, it was interesting to observe that an enlarged pulsating liver did not at once diminish in size, but retreated only after a number of days to its normal dimensions. Similarly, we could not observe any reductions in the heart outlines, either immediately or subsequently. Blood-pressure also was little affected, but showed a tendency to a moderate rise whenever decisive slowing occurred. The cases which reacted decisively did not, except in one instance, revert to a regular rhythm, but continued to fibrillate at a lower rate.

CASES STUDIED. Of the 20 cases in this series, 10 showed the pulsus irregularis; in 9 of these it was constant, in 1 it interrupted the normal rhythm in paroxysms; 10 cases had at all times a regular, rapid pulse, 9 of these being an acceleration of the normal pacemaker rhythm; 1 being a case of paroxysmal tachycardia of auricular origin.

With one exception all the cases studied showed a valvular lesion, with accelerated pulse. In the one exception there was pulse acceleration without cardiac lesion in a postoperative laparotomy, terminating fatally.

Of the cases with pulsus irregularis, 6 had a rapid pulse (in all cases over 100) and slight dyspnea, but no further symptoms. The other 4 were seriously ill. The reaction in all cases was decisive, the pulse rate dropping from 20 to 60 beats per minute, the maximum of reaction being reached in twenty minutes to eight hours. In one instance, where three doses of $\frac{1}{120}$ gr. were given during a week, the maximal reaction did not occur until one hour after the final injection (Fig. 3).

Of the 4 serious cases, 1 on the service of Dr. James D. Heard, at St. Francis' Hospital, afforded very striking results. This case has been reported in detail.[7] It will suffice to say that from a condition of extreme dyspnea with a totally irregular apex beat of 164, pulmonary congestion, enlarged pulsating liver, and great edema of the lower extremities, the patient was brought in twenty minutes after the injection of $\frac{1}{120}$ gr. to a condition of comfort, with an apex beat of 116. Four hours later a second injection of $\frac{1}{120}$ gr. was given, bringing the pulse to 100, after which the oral administration of digitalis was begun.

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[6] Loc. cit.

[7] Cohn, A. E., and Heard, James D., A Case of Auricular Fibrillation with Postmortem Examination, Archives of Internal Medicine, June, 1913.

Two instances of pulsus irregularis occurred in association with pneumonia. In both instances the irregularity antedated the pneumonia—in the first by ten years and in the second by three. There was a severe toxemia. In the first case $\frac{1}{120}$ gr. of strophanthin reduced a pulse of 160 to 80 in one hour. In the second case the same dose caused a drop from 144 to 92 in the same time. Notwithstanding the strikingly favorable results as to the cardiac mechanism, both cases pursued their unfavorable course to a fatal termination.

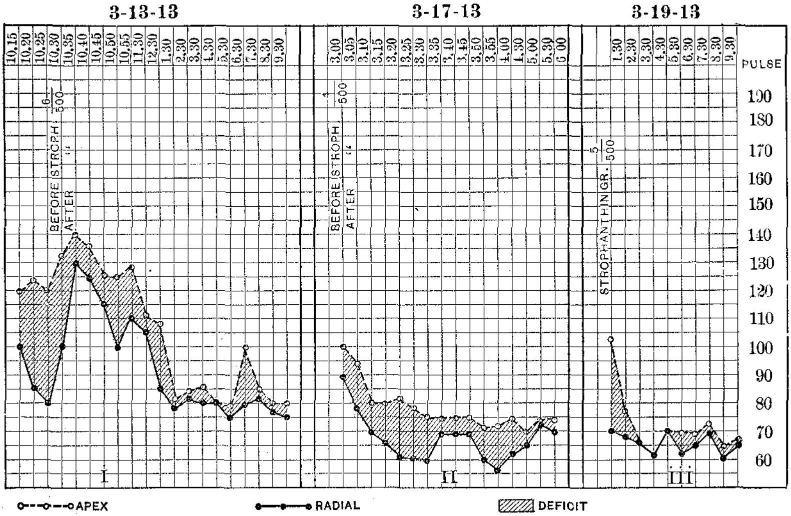


FIG. 3.—Showing progressive lowering of apex rate and pulse deficit by repeated injections of strophanthin.

The last case with occasional pulsus irregularis occurred on the service of Dr. R. T. Miller, Jr., at St. Francis' Hospital, where he had been admitted for a gall-stone operation. One paroxysm of pulsus irregularis occurred before operation, but terminated spontaneously. Two others occurred after operation, with an apex rate of 140 and great distress. In each postoperative instance the normal rhythm, at a rate of 76, was resumed within one-half hour after administering $\frac{1}{120}$ gr. strophanthin. However, it is difficult to say how far these injections were responsible for any improvement in view of the spontaneous termination of the first attack.

CASES PRESENTING A REGULAR RHYTHM. Of 10 cases with regular pulse rate, 3 showed a definite slowing, though in all the circumstances were such as to make them exceptional cases. One, a case of advanced decompensation, showed for a few minutes only a drop in rate of 14; in one the rate fell to half of what it had been a few moments before, but this was speedily followed by a rise in rate and a fatal termination; and another, with paroxysmal tachycardia of auricular origin, resumed its normal rate. Seven were unaffected (Fig. 4).

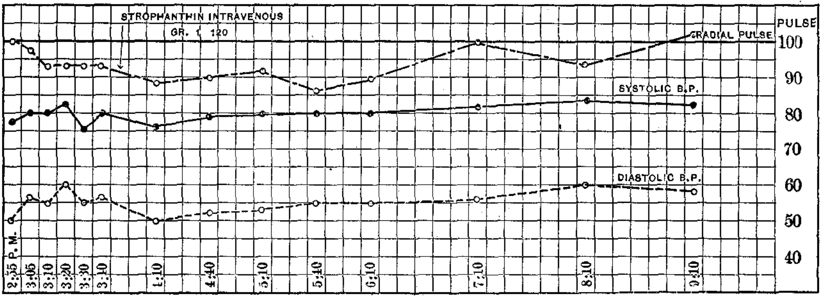


FIG. 4.—Case I. R. B. (regular rhythms). Showing action of $\frac{1}{120}$ gr. strophanthin. Effect very slight and transitory.

The cases reacting, all of them atypical, were as follows:

1. *Paroxysmal Tachycardia of Auricular Origin.* When first seen the attack had been going on for twelve days. Apex rate, 208 per minute and regular. Skin and mucous membranes moderately cyanotic, veins of the neck distended and fluttering rapidly. Heart one and one-half inch to the right and four inches to left of midline in the third interspace, with faint tic-tac sounds and no murmurs. Liver a trifle below the costal border; slight pitting of the skin over the tibiæ. Twelve days after the onset of this attack gr. $\frac{1}{60}$ strophanthin was injected, with no effect on the pulse rate. Eleven days later, the twenty-third day of the attack, gr. $\frac{1}{60}$ strophanthin was again administered at 9.30 P.M. One hour later there was no change, but when next seen at 8 A.M. the following morning the pulse was found to be 84, and remained at this rate thereafter. The patient volunteered the information that at midnight, following the injection, he had felt a sudden relief. Here again it is difficult to say whether the sudden relief was due to strophanthin or whether it was given coincidently with the spontaneous cessation of the paroxysm.

2. A patient, aged sixteen years, female, with mitral insufficiency and advanced decompensation, pulse rate 104 and regular, was given gr. $\frac{1}{60}$ strophanthin. In two hours the pulse rate had dropped to 84, but remained so only for a little while, and rose again steadily until her death, which occurred on the same day.

3. *Overdosage.* The patient, a colored girl, aged fourteen years, suffering with acute articular rheumatism, endocarditis, and pericarditis; pulse rate 124, regular rhythm. Weight eighty pounds;

$\frac{1}{60}$ gr. strophanthin was administered at 11 A.M. At 11.15 the pulse was 64 and of an irregular rhythm not determined, as there was no time to apply a polygraph. Immediately after, Cheyne Stokes breathing ensued, the pulse rate rose again to 110, and at 11.30 death occurred. In this case the dose was too great in proportion to her body weight and her serious condition. Though death seemed impending, there is no doubt that the strophanthin injection materially hastened it.

CONCLUSIONS. 1. The action of strophanthin administered intravenously is similar to that of other members of the digitalis group administered orally, but far more rapid.

2. Strophanthin had, in this series, a decisive effect in all cases with pulsus irregularis perpetuus. Where the pulse rhythm was regular, it showed an effect in only three instances out of ten, and this was both slight and transitory, except for the case of paroxysmal tachycardia.

3. In desperate cases of the pulsus irregularis perpetuus type, strophanthin administered intravenously will tide the patient over until digitalis, orally administered, has time to take effect.

4. In cases of the pulsus irregularis perpetuus type, the first effects are noted in twenty to thirty minutes, though the maximum may not be apparent for seven or eight hours. This effect lasts from three to ten days.

5. It does not seem advisable to give on any one occasion more than gr. $\frac{1}{60}$, and this, if repeated, should not be done before forty-eight hours; $\frac{1}{120}$ gr. has given a maximum result. On the other hand it may sometimes take more than $\frac{1}{60}$ gr. to produce this.

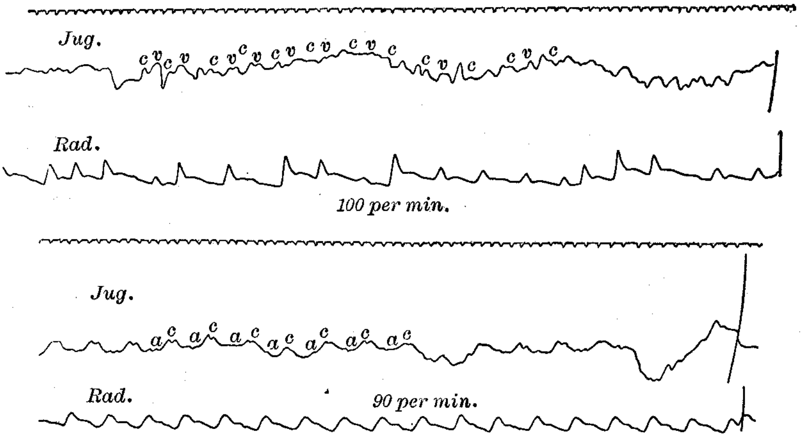
6. Two cases of paroxysmal tachycardia are reported with strophanthin administration, both followed by cessation of the attacks. It is not clear, however, to what extent the strophanthin was responsible for this phenomenon.

REPORT OF CASES WITH IRREGULAR RHYTHM.

CASE I.—Mitral stenosis; auricular fibrillation. Mrs. T. G. (service of Dr. James D. Heard, St. Francis Hospital), white, aged thirty-seven years. Complained of shortness of breath and cough. A previous history of chorea and acute rheumatic fever. On admission she had a diffuse precordial heave—a rough vibrating thrill—and a soft presystolic murmur rising in crescendo to a booming first sound. Pulmonic second sound greatly accelerated. Pulse was regular in rhythm and 120 to the minute. Lower border of the liver two and one-half inches below the costal margin. No edema. After two doses of ♏xv each of tincture of digitalis, she suddenly developed auricular fibrillation, which continued until her death five months later. After a few weeks she was discharged, with a pulse rate of 90 and feeling comfortable.

Two months later she returned to the hospital in an alarming state of decompensation—extensive swelling of the legs and abdomen, extreme orthopnea, a cough with frothy blood-tinged expectoration, and an irregular pulse of 160 to the minute, small and thready. The lower border of the liver extended 3 inches below the costal margin. There was marked congestion of the pulmonary bases and the heart sounds too tumultuous to analyze.

At 11 A.M. on the day after her second admission she received $\frac{1}{120}$ gr. strophanthin. Apex rate at this time was 160 per minute. At 11.30 her apex rate had dropped to 104 per minute and she was feeling comfortable. At 3.30 P.M. she received another dose of gr. $\frac{1}{120}$, bringing her apex rate in thirty minutes more to 100 per minute. At this time digitalis was administered by mouth and her lowered heart rate continued, aided by this oral administration. She left the hospital one month later in comfortable condition and with a heart rate of 84. The edema of her extremities and her engorged liver did not at once recede, but diminished slowly during the ensuing month.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Rad.
90 per min.

FIG. 5.—Case II (normal rhythm). Mr. S. Showing spontaneous reversion from auricular fibrillation to normal rhythm before operation.

CASE II.—S., male, white, aged sixty years; gall-stones; myocarditis; auricular fibrillation occurring in paroxysms. Patient was admitted for cholecystotomy. Pulsus irregularis; heart rate of 100. After three days in the hospital his heart suddenly reverted to a normal rhythm, with a pulse rate of 90. There was nothing in his treatment to explain this, save an unusually effectual enema.

Operation ensued and was successfully completed without any unfavorable results. Twenty-four hours after, he became dyspneic and cyanotic, and he again showed auricular fibrillation, with a heart rate of 144. $\frac{1}{120}$ gr. strophanthin was at once administered intravenously. Within an hour the pulse rate had dropped to

80 and, moreover, had resumed a regular rhythm. It remained so until the next day, when auricular fibrillation again was inaugurated, with extreme distress. A similar dose was again injected and a drop not only to the normal rate, but rhythm as well ensued within an hour and remained so until his discharge from the hospital in good condition one month later (Fig. 5).

Case III.—G. F., white, male, aged fifty-four years. Mitral insufficiency; myocarditis, auricular fibrillation.

The patient, an attorney, when seen had had an irregular heart action with dyspnea on exertion for four years, but had been incapacitated for only the past four months. The apex rate was 168, with slight pulmonary congestion, but no signs of congestion in other organs.

Strophanthin gr. $\frac{1}{120}$ given intravenously resulted in a drop to 120 within one and one-half hours. No further strophanthin was given, and the heart remained at this rate for three days, when digitalis orally administered on the first day in doses f℥j per day began to take effect, and one week from the time that he was first seen the heart rate was 78 and the general condition so improved that he wanted to return to work.

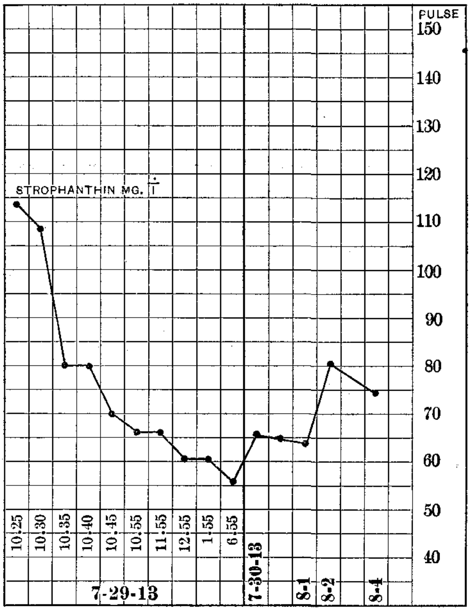

Fig. 6.—Auricular fibrillation. Case IV. Showing pronounced and rapid effect of injection of $\frac{1}{60}$ gr. strophanthin. The curve represents the apex rate.

Case IV.—S. L., female, white, aged twenty years. Mitral insufficiency and auricular fibrillation.

She never had rheumatism or chorea, but had suffered with a number of attacks of sore throat. Three years ago she began to complain of shortness of breath on the slightest exertion, which has continued with slight remission ever since.

On admission her heart rate was 120 per minute, and totally irregular. There were no signs of secondary congestion, and she was only moderately dyspneic. At 10.25 A.M. she received $\frac{1}{60}$ gr. strophanthin intravenously. At 12.30 her heart rate had dropped to 60. A few hours later it had further dropped to 55 and did not begin to go up again until the third day afterward. Her condition remained comfortable throughout (Fig. 6).

CASE V.—C. G., Italian, male, aged fifty years. Myocarditis, with auricular fibrillation. During the previous three years he had had a number of attacks of multiple arthritic pains, but had never been laid up. In the past year there have been occasional attacks of shortness of breath. No further symptoms. Venereal history negative.

On admission, pulsus irregularis; heart rate 140. Heart outlines two and a half inches to the right and four inches to the left of the midline in the third interspace. Cardiac respiratory murmur present, but no actual heart murmurs. Moderate cyanosis. Very slight pitting over tibiæ. Three injections of strophanthin were given (Fig. 3). March 13, $\frac{1}{80}$ gr. reduced the heart rate in three hours from 140 to 80, almost wiping out the pulse deficit. On March 17, the pulse having again risen to 100, $\frac{1}{120}$ gr. was administered with a drop to 75 in fifty minutes. On March 19, the pulse having risen again to 100, he was given a third injection of $\frac{1}{100}$ gr. with a drop in three hours to 68. He left the hospital one month later in excellent condition.

CASE VI.—J. D. (service of Dr. Nelson H. Clark, St. Margaret's Hospital), white, aged forty-four years. Myocarditis with auricular fibrillation. No history of rheumatic fever, chorea, tonsillitis, or any acute infection. Eight months ago, while at work, he became suddenly short of breath, and slight exertion since that time has brought on dyspnea.

RECORD OF TREATMENT.

		Apex.	Radial.	Systolic blood-pressure.
December 15,	9.45 P.M.	134	84	120
	10.05 P.M.		Strophanthin, gr. $\frac{1}{102}$	
	10.12	128	72	123
	10.17 P.M.	132	54	130
	10.22 P.M.	124	56	130
	10.27 P.M.	118	56	135
	10.35 P.M.	120	52	132
	10.45 P.M.	115	48	130

		Apex.	Radial.	Systolic blood-pressure.
December 16,	4.25 P.M.	126	52	121
	4.32 P.M.		Strophanthin, gr. $\frac{1}{120}$	
	4.38 P.M.	110	76	130
	4.43 P.M.	90	84	125
	4.50 P.M.	96	88	125
	5.00 P.M.	94	84	125
December 22,	2.36 P.M.	104	..	118
	2.41 P.M.		Strophanthin, gr. $\frac{1}{100}$	
	2.46 P.M.	100	..	128
	2.51 P.M.	88	..	130
	2.56 P.M.	88	..	134
	3.01 P.M.	88	..	134
	3.06 P.M.	80	..	134
	3.11 P.M.	76	..	137
	3.16 P.M.	80	..	134
	3.21 P.M.	82	..	134
	3.26 P.M.	84	..	134
	3.31 P.M.	80	..	138

CASE VII.—Miss R. (service of Dr. Nelson H. Clark, St. Margaret's Hospital), white, aged thirty-eight years. Mitral stenosis—auricular fibrillation—with a previous history of rheumatic fever. The patient was a small, frail woman, very wretched on account of the nervous discomfort produced by the sensation of fluttering about her heart. More frequent injections were used with her than with any other patent. They occasioned her such prompt relief that she used to ask for them.

		Apex.	Radial.	Systolic blood-pressure.
November 3,	4.30 P.M.	108		
	4.35 P.M.	118		
	4.45 P.M.	112		
	4.50 P.M.		Strophanthin, gr. $\frac{1}{80}$	
	5.00 P.M.	90		
	5.05 P.M.	88		
	5.13 P.M.	84		
	5.18 P.M.	78		
	5.25 P.M.	76		
	5.30 P.M.	76		
	8.00 P.M.	74		
	9.00 P.M.	82		
	10.00 P.M.	70		
	11.00 P.M.	80		
	12.00 P.M.	80		
November 20,	9.35 A.M.	132	96	65
	9.40 A.M.		Strophanthin, gr. $\frac{1}{70}$	
	9.45 A.M.	128	88	78
	9.50 A.M.	100	84	95
	9.55 A.M.	88	83	95
	10.00 A.M.	86	84	
	11.00 A.M.	88	85	
	1.00 P.M.	..	78	
	2.00 P.M.	..	78	
	3.00 P.M.	..	68	

Eight more similar injections were given, with like result, and the patient to the present time prefers this form of treatment to oral administration.

CASE VIII.—J. B., white, male, aged forty years. Coal miner. Auricular fibrillation, with myocarditis. No history of previous infections. Several months previous to admission he experienced shortness of breath, with a fluttering sensation, while at work. He is quite comfortable when at rest. Apex rate 110; $\frac{1}{60}$ strophanthin caused a drop in one hour to 84, the effect lasting for two days.

CASE IX.—M. B., white, aged thirty-six years. Lobar pneumonia, with grave toxemia. Auricular fibrillation, with a heart rate of 160. No dilatation. Two days before his death he received $\frac{1}{60}$ gr. strophanthin, with a drop in heart rate in one hour to 80. The patient's condition remained unimproved, and the heart rate again rose steadily to 150. On the following day he received another injection, with a similar drop, but in spite of this, he became progressively worse, and died the same evening.

CASE X.—A. S., Italian, aged thirty-six years. Lobar pneumonia, with severe toxemia and delirum. Auricular fibrillation, dating back three years. Heart rate, 144. Twenty-four hours before his death, which occured on his third day in the hospital, he received gr. $\frac{1}{60}$ strophanthin. One hour later the apex beat was 92. His general condition, however, remained unaffected, and with the heart rate rising again steadily, he died the same day.

CASES WITH NORMAL RHYTHM.

CASE I.—R. B., white, female, aged sixteen years. Mitral insufficiency and stenosis. Pulse regular, 100 per minute. Gr. $\frac{1}{120}$ strophanthin caused a drop of eight beats in her pulse rate. It quickly rose again, and by evening the rate was again 100 (Fig. 4).

CASE II.—E. O., female, aged fourteen years. Mitral insufficiency and stenosis, with early decompensation, acute pericarditis, a frail girl; heart, one and one-quarter inches to the right of midline and three and one-half inches to the left in the third interspace. Pulse 120, regular; occasional edema of the ankles; mitral systolic murmur, pericardial frictions. Liver two fingers' breadth below the costal border. Strophanthin $\frac{1}{60}$ gr. produced no effect on the pulse rate. Later she was given tincture of digitalis by mouth, 1 dram a day, until she took 10 drams in all, when it was discontinued, owing to slight headache. The pulse at this time showed occasional slowing, due to a heart-block which had been induced, but which disappeared two days after discontinuing the digitalis.

CASE III.—H. M., aged sixty years. Aortic insufficiency. Pulse 130, regular. Strophanthin $\frac{1}{100}$ gr. reduced the pulse rate from 130 to 125, but within an hour it had risen to the original rate;

it seems scarcely reasonable to interpret so slight a difference as the result of the injection.

CASE IV.—Mrs. C., aged forty-two years. Mitral insufficiency; beginning of decompensation; regular pulse rhythm, 120 per minute. Strophanthin $\frac{1}{60}$ gr. had no effect upon her pulse rate.

CASE V.—C. R., male, aged forty-two years. Mitral insufficiency; pulse rate 110, regular; $\frac{1}{60}$ gr. strophanthin had no effect on his pulse rate.

CASE VI.—Mrs. B., aged thirty-five years. Seen after laparotomy; temperature 22, pulse 120, regular but weak and thready. Strophanthin $\frac{1}{80}$ gr. injected to note any possible effect; the patient was in a serious condition at the time it was given. The injection not only had no effect, but the pulse continued to rise steadily to 180, maintaining its regular rhythm throughout until the time of her death, which occurred the second day.

CASE VII.—B. H., male, aged forty years. Arteriosclerosis; myocarditis; pulse rate, 100. No evidences of decompensation. Dose used $\frac{1}{60}$ gr. There was no lowering of the pulse observed.

CASE VIII.—F. B., male, aged forty-one years. Paroxysmal tachycardia of auricular origin. Myocardial insufficiency. Pulse rate estimated by polygraph, 208 per minute; when seen, the attack had lasted twelve days, coming on without apparent cause in the middle of the night. No history of any previous infections. Skin and mucous membranes moderately cyanotic. Heart apex in the fifth interspace three and a quarter inches from the midline. No murmurs present; liver border, one finger breadth below the costal margin. Strophanthin $\frac{1}{60}$ gr. injected without effect. Edema of the legs came on; the apex of the heart extended out from the midline and the liver gradually went down to the level of the umbilicus. Eleven days after the first injection a second injection of $\frac{1}{60}$ gr. was given at 9.30 P.M. Two hours later no change had been noticed; when next seen, on the following morning, the pulse rate was 84 to the minute and regular. It remained so for the rest of his stay in the hospital. While it is not known at what time the drop in pulse rate began, the patient stated that at midnight following his injection he experienced a sudden relief, and the change in rate probably occurred suddenly at this time.

CASE IX.—A. M., female, aged twenty years. Mitral insufficiency, with advanced decompensation. Had not improved to any extent under oral administrations of digitalis, although she had received in all eight drachms of the tincture. With the onset of nausea, digitalis was discontinued. She continued unimproved and gradually weaker and more dyspneic. Two weeks following the discontinuance of digitalis, and at a time when she appeared to be growing extremely weak, she was given an injection, $\frac{1}{60}$ gr. strophanthin. The pulse rate at the time of giving the stophanthin. was 104, and an examination made an hour subsequently showed that the pulse rate had dropped to 86, but within eight hours it had risen again and death occurred on the same day. Although no records were made with the polygraph, there is little doubt that most of the apparent slowing in this instance was due to the production of extrasystoles.

CASE X.—C. W., colored, aged fourteen years. Endocarditis; pericarditis; acute articular rheumatism. Patient when seen was sitting up in bed, gasping and very weak: pulse rate was regular, and 124 to the minute. It was decided to give her an injection of $\frac{1}{60}$ gr. strophanthin, with the fatal effect observed in the previous discussion.

THE VALUE OF COLONIC INFLATION IN THE DIAGNOSIS OF CHRONIC APPENDICITIS.[1]

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THE frequent association of chronic inflammation of the appendix with persistent gastro-intestinal disturbances is being more and more recognized, but the diagnosis of chronic or subacute appendicitis is, nevertheless, a matter of no little difficulty, particularly in those cases which have had no history of a previous acute attack. In many instances, pain in the right iliac fossa, either spontaneous or induced by pressure, furnishes the clue to the diagnosis, but in many other instances there is an absence of this feature, the chief symptom being abdominal pain of more or less definiteness. Granting that there is well-marked pain in the right iliac fossa, one is still not justified in concluding that the cause of the pain is appendicular in origin, without excluding disease of organs situated in the right upper and lower quadrant of the abdomen, notably the Fallopian tube, ovary, kidney, and gall-bladder, a matter at times beset with difficulty.

The frequent occurrence of latent appendicitis and the difficulty attending its diagnosis has led Bastedo to advance a new test, the dilatation test, in order to determine the presence of chronic appendicitis. He passes a colon tube, eleven or twelve inches, into the rectum and injects air by means of an atomizer bulb. "If, as the colon distends, pain and tenderness to finger-point

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[1] Read at a meeting of the American Gastro-enterological Society, Atlantic City, June 22 and 23, 1914.